

Calculator Professional Use Survey

Richard J. Nelson

Whenever calculators are discussed among enthusiasts there are often unspoken assumptions implied by individuals and the group as a whole. These assumptions range from the best operating system, the best solution method, the best model, the best place to buy, etc. One of the “assumptions” that I hear most from non-enthusiasts is that calculators are obsolete. Professionals, like technical managers, wonder why people even spend time discussing them. I believe the primary reason for this “assumption” is the idea of convergence. Obviously your PDA is able to provide a calculator function so, “Why would you buy a dedicated calculator? After participating in several of these vigorous discussions I decided to ask calculator user friends a few questions related to their calculator usage. The questions were not scientifically well thought out kinds of questions. They were a few simple questions related to the professional use of a scientific or graphing calculator. I did not ask about age, employer, number of years of usage, etc. Here are the results.

Number of surveys sent: 70

Number of surveys returned: 33 (20 by email, 13 in person)

Questions: 10

Since I personally know most of the respondents I have some insight to their answers. Most of the respondents are experienced professionals in their late 30’s and older. At least two are retired. Thirteen surveys were delivered in person from three companies in the building where I work and I spent 15 to 20 minutes talking to each of them about how they used their calculators. One engineer has designed calculators for a well known company (not one of the big four). The survey may be found in appendix A. Each question is reproduced below with the tally of the answers.

1. What is your profession? This question is increasingly difficult to ask of an older experienced professional. Many people change their professions over the course of their working careers due to rapidly changing technology and the creation of completely new fields. The classical example is an engineer moving into management or teaching. Below is the list of professions as the respondents expressed them. A few gave multiple professions and I used the one I knew was most fundamental to their working careers or training. Eighteen different professions are represented by the 33 respondents.

Table 1 — Calculator User Professions

#	Profession	Resp.	#	Profession	Resp.
1	Biomedical Engineer	2	10	Mechanical Engineer	4
2	Chemist	1	11	Quality Assurance engineer	1
3	Computer Programmer	2	12	Reliability Engineer (microelectronics)	1
4	Electric Power Engineer	1	13	Software Developer	1
5	Electronics Engineer	7	14	Software Development Manager	1
6	Electronics Technician	2	15	Software Engineer	2
7	Land surveyor	1	16	Structural Engineer	1
8	Lawyer	1	17	Technical Writer	1
9	Mathematics Teacher	2	18	University Professor	2

2. Do you own or use a Scientific or Graphing Calculator? All but one answered yes. The single no answer was from a PHd Astrophysics trained Software Engineer. He added, “but my

kids do.” The third part of the question asked why not. He responded that he uses his head or the computer.

The second part of this question asked the respondent to list their machines. The tables below provide the tally.

Models were cited for all of the big four manufacturers; HP (59), TI (8), Casio (2), Sharp (1). One four function was cited and eight respondents said that they had many other machines but didn’t list them. Many respondents had multiple machines and the average number of reported machines per respondent was 2.1. The TI and Casio users didn’t list as many multiple models as the HP users. It seems that the HP users more easily remembered their machines and were proud to list them on the survey. Several respondents listed machines of two manufacturers.

Table 2A Hewlett-Packard Models Listed by Respondents

Model No.	Qty	Model No.	Qty	Model No.	Qty
HP-10B	1	HP38g	1	HP-48g	2
HP-10BII	1	HP39g	1	HP-48gII	1
HP-11C	1	HP39g+	1	HP-48GX	12
HP-15C	2	HP40g	1	HP-48SX	5
HP-16C	1	HP40gs	1	HP-49g	9
HP-28S	1	HP-41C	2	HP-49g+	8
HP33S	1	HP-41CX	2	HP-65	1
HP-35	1	HP-45	1	HP-67	1

Table 2B Texas Instrument Models Listed by Respondents

Model No.	Qty	Model No.	Qty	Model No.	Qty
TI-30XA	1	TI-81	1	TI-92	1
TI-36	1	TI-82	1		
TI-59	1	TI-85	2		

Table 2C Casio Models Listed by Respondents

Model No.	Qty	Model No.	Qty
fx-115M	1	Solar	1

Sharp EL-506 Qty 1

3. Did you use the same machine while in school? Yes = 7 No = 26

There were two common reasons listed as to why the respondents are not using the same machine that they used in school. The majority listed a different model that they used “back then.” There were quite a few who listed the slide rule as their student’s “machine.” Several respondents had used a TI in school and bought an HP after leaving school. The reverse was not reflected in the survey.

4. How often, an estimated average, do you use your machine? This is a good example of not thinking ahead in terms of wording the questions to make the tally easy. While that may provide numerical values for decision making, the “free form” of the answers provide a more realistic picture of usage. The answer was not asked in specific units so the respondents described their usage in different ways.

Table 4 — Scientific or Graphing Calculator Usage

Use Frequency	Resp.	Use Frequency	Resp.	Use Frequency	Resp.
Every waking Hour	1	Twice per month	1	Once per Year	1
Every Day	11	One Hour per day	3	Rarely	2
Twice a Day	4	Three minutes per week	1	Never	1
Several times a day	3	Several times per week	1	No Response	1
Six times a day	1	Three times per week	1		
20 times a day	1	5-10 times per week	1		

5. What kinds of problems to you use your machine for? This is a typical question that should have been better thought out. Question seven refines this issue. Many respondents answered in terms of the problem type rather than math of the problem. The idea of the calculator providing immediate answers was expressed in their answers. The number of respondents that wrote a similar description of the kinds of problems they solve is in the “Rsp” column. The kinds of problems are not listed in any particularly order. Of the 24 ways the respondents answered the question only two mentioned programming. One specifically said recreational programming.

Table 5 — Professional Calculator Usage

#	Kinds of Problems	Rsp	#	Kinds of Problems	Rsp
1	General math, engineering	3	13	Structural Analysis and Design	1
2	Simple arithmetic, Trig.	1	14	Stat., Finance, Engineering	1
3	Calculations	1	15	HVAC, Math, Engineering	1
4	Conversions, Stat., Logs, Trig. Derivatives, Integration, plotting	5	16	General sanity check, check computer results	1
5	Heavy Statistics	1	17	General Math, Arithmetic	2
6	None	1	18	Algebra, Trig. some Stat.	1
7	Ckt. Design estimation, general	1	19	Factoring and Statistics	1
8	Financial and Scientific	1	20	Trigonometry	1
9	Hex Conversion., Arithmetic, test PC Programming	3	21	Arithmetic, Units, Time & Date, Base conversions, plotting,	1
10	Simple quick calculations	1	22	Currency Conv., %, Arithmetic	1
11	Math investigations, Searches, Programming, Data analysis	1	23	Math, Statistics, Modeling, Multiple Equation. Solver	1
12	Astronomy and Finance	1	24	General Stat., Alarm Clock, Prog.	1

5. What computer software do you use to solve mathematic/design problems?

Computer usage for mathematical problem solving is absolutely required in a normal business, engineering, or manufacturing environment because the data and the results must be shared in emails, procedures, proposals, reports, studies, etc. Microsoft Excel and Excel with macros is by far the most widely used mathematics computational program with 64% of the respondents reporting that they use it. MathCAD comes in as a close second with 36% of the respondents saying that they use it. The programs listed below are in no special order. The number of respondents reporting that they used the program is in the No. column.

Table 6 — Computer Math Software Programs used by Calculator Users

#	Program	No.	#	Program	No.	#	Program	No.
1	Excel	21	13	MATLAB	1	25	Derive	1
2	MathCAD	12	14	SPICE	1	26	Model Maker	1
3	Respondent written	3	15	S-PARAM Sim	1	27	Delphi	1
4	Math Journal	2	16	2&3D RISA FEA	1	28	Altium/Protel	1
5	None	2	17	Enercalc	1	29	AutoCAD	1
6	PSPICE	1	18	ADAPT	1	30	CivilCAD	1
7	Graphit	1	19	Emu48	1	31	Starplus	1
8	Solid Works	1	20	Mathematica	1	32	POVray	1
9	COSMO Works	1	21	Too many to list	1	33	Quatro Pro	1
10	Statistica	1	22	MSC Nastran	1	34	PentaCalc Pro	1
11	SPCXE	1	23	Flex PDE	1	35		
12	MENTCR	1	24	Curve Expert	1	36		

7. What is the most common use(s) you have for your machine? This question, related to question five, was more specific. Still there was an assumption which most respondents realized. One respondent thought that the math function usage was for his computer. Again, survey questions are always difficult to prepare and they are often unclear to some respondents. Four respondents described what they used their machine for instead of selecting the A through J choices. These choices were incomplete as indicated by the * added choices in the table below.

Table 7 — Scientific or Graphing Calculator Math Function Usage

Type of problem most commonly used	No.
A. Simple four function math (balancing the check book).	22
B. Conversions, especially English-Metric.	14
C. Interest calculations.	8
D. Repetitive calculations done with a short simple program.	11
E. Statistical calculations.	12
F. Higher level math calculations involving logs and trigonometric functions.	19
G. Very high level or advanced math functions such a integration, Bessel functions.	4
H. Specialized calculations involving complex dedicated programs.	7
I. Symbolic math calculations.	3
J. Analysis of data or functions that requires plotting.	4
* K. Matrix Calculations	1
* L. Base Conversions	2
* M. Complex numbers	1
*N Programming to solve problems.	2
Respondent didn't use choices given.	4
Respondent didn't do any calculations	1

* Added from respondents answers

8. Considering spread sheet programs, e.g. Excel. Do you see more use of a computer when dealing with multiple data compared to a calculator? Is this the type of question that is very obvious and you already know the answer? Yes = 30 No = 2 Yes and No = 1.

The last answer is explained by the respondent. “Yes and no, the computer is there to give me answers – the calculator is an extension of my mind, thinking through problems, trying things and working out what calculations are appropriate, and then what kind of answers to expect.”

While most respondents simply wrote yes or no several provided additional information. Several respondents mentioned other software related to spreadsheet usage (included in Table 6). Here are the written comments.

1. “Also to save calculations for later modification (e.g. design of circuit change requires new calculations).”
2. “The calculator is better for single calculations, but if the calculation will need to be made often oOr on a different day, the spreadsheet is the better tool.”
3. “Sure for other people, but I always seem to make my data fit my machines” *rjn note. This is the same respondent whose answer appears first in table 4.*
4. “Because I usually require printing on 8-1/2 x 11 paper including text related to the calculations.”
5. “No, a good programmable calculator can do anything that Excel can do except for data display.”
6. “Yes, except for simple situations.”

9 Would you say that symbolic math programs such as Maple, MathCad, etc. are mostly used in your profession instead of calculators?

<u>Response</u>	<u>No.</u>
Yes	13
No	14
?	1
Equally	1
Don't know	3
Possibly	1

These experienced respondents are about equally divided on the day to day use of symbolic math computer programs. This is probably biased by the large number of engineering fields represented. Engineering usually requires a numeric answer and numerical approximation is acceptable. Here are the written comments.

1. “Yes, for repeated calculations.”
2. “No, I'd say calculators still see significant use for more simple functions.” (TI user).
3. “Used for more complex problems.”
4. “Yes, although the calculator is more convenient.”
5. “No, not really but might with new grads of colleges.”
6. “No. Both are essential tools; one does not replace the other.”

7. "No. CAS is coming in but only at the level of the CAS on an HP40gs (or HP40G or HP49g+)."
8. "I would say Excel is used far more in the engineering modeling world than the symbolic programs mentioned."

10. Do you use a calculator (emulator) program on another machine, computer, PDA, etc.?

Yes = 19 No = 13 No response = 1.

We are all dependent on machines for complex math calculations so it is not surprising that the majority of these professionals also have calculator emulators on their computers. This question also raises the question of which emulator they used. Several respondents who answered yes also said seldom or rarely used. Here are the entries.

1. "Yes, my PC (sometimes).
2. "On the computer but very rare."
3. "Yes, rarely."
4. "Only when I don't have my calculator with me."
5. "PDA & cell Phone."
6. "Seldom, but it is handy when you would have to walk away to find the calculator."

At the very end of the Questionnaire I added.

Feel free to write any comments, observations, etc. regarding calculator usage below.

Six respondents expanded their thoughts.

1. Jefferson Bronfield — Electric Power Engineer.

"I don't see the computer supplanting the need for a hand held computer, for several reasons:"

"Having grown up just after the slide rule, I am lousy at estimating orders of magnitude in my head, indeed all mathematical estimating is awkward for me – (Remember I am of the generation that added 0.001 to 10^7 and thought the answer significant.) - I have become dependant on the calculator as an extension of my computational, arithmetic and mathematical thinking, so dependant that I routinely find myself doing real simple calculations I could have done in my head, just because I am not in the habit. (divide by 5% when I could just as easily multiplied by 20 in my head)."

"I don't believe a desk top or lap top computer will ever be able to become that for me – or anyone, and I don't believe computer programs and tools will ever totally eliminate the need for the mental math I can't do without my calculator."

"Back when the calculator was the ONLY personal digital computing device available – we asked it to do all kinds of things that are easier done today with desk top computer – so where the functionality overlaps the computer will win. But where they don't overlap, there is need for both. And they will never totally overlap."

“Try these on:”

“You are driving on the interstate, and you need to quickly figure out how many miles you can go on an 8th of a tank of gas – do you wish you had your calculator, or your computer?”

“You are doing some comparison shopping on line, you have three websites open, and you need to calculate if that price, plus tax and delivery charge, is still a bargain – do you reach for your calculator, or do you click around for you’re a spreadsheet or mathcad?”

“You are on a strict diet, and have two carbohydrate exchanges (30g) left in your daily allotment. You crave some cookies, and the nutrition label gives the carbohydrates for one serving, but one serving is 2/3 of a cookie. Do you reach for your calculator, or fire up your computer?”

“You are planning to surprise your spouse by baking him or her a cake – and you only have ¾ of the box mix left – you need to adjust the required amount milk and molasses - do you reach for the computer or the calculator?”

“The telephone company calls with a deal for unlimited monthly long distance for one monthly fee, and you have gotten in the habit of using calling cards at 4 cents a minute – In order to see if the telephone company offer saves you money do you run to your computer, or pick up your calculator?”

“You need to interpolate the probable value of a missing data point, on an uncharted table of numbers – lets say you need to do this while you are on the phone.”

“I am sure we could all come up with hundreds of instances where the calculator is indispensable, and the computer is of no help.”

Chris Randle pointed out the following that probably applies to at least 2/3rds of the respondents.

2. Chris Randle – Computer Programmer.

My usage of calculators is skewed by the fact that they are a minor hobby, and I love them for their own sake. If I didn't have this unusual attachment to them, I think my usage would be far less. Quite possibly I would use one only on very rare occasions, and might well hunt around for someone else's 4-banger to borrow when I found the need.

3. Gary Friedman — Engineer, Entrepreneur

I used to use my machine constantly 20 years ago – it was as much a constant part of my life then as iPods are to today's youth. Today, when faced with a need for high math, it is rare that I'm away from a computer, and with spreadsheets I can share my thought processes and calculations with others simply by emailing them. If I had a need for symbolic math or isolating a variable (which I rarely do since I'm not engaged in engineering tasks anymore), I'd grab my 48.

4. Roger Hill – University Professor.

“I find a calculator more convenient than a desktop computer for keying in and doing quick calculations or entering data like exam scores, etc, which are not already in a file. Of course

a calculator is also more convenient when away from a desktop computer. I used to use a calculator (particularly the HP-41C) for practically everything, but have gone to desktops and spreadsheets more nowadays. For tables and graphs I like spreadsheets better as they have a large screen and allow printing out more easily.”

“I also use my HP-48SX (and formerly used my HP-41C) as a backup alarm clock, as its alarm is just about the right loudness for me.”

“For school, I have not emphasized symbolic math on calculators in my courses, as a significant part of the goal of the courses is to get practice in doing algebra correctly. However, I do encourage the use of integral tables and welcome the use of calculators in doing symbolic integration if the students have it available. For numerical work and graphing I have encouraged the use of spreadsheets like Excel.”

“In labs, I used to have them do at least one statistical calculation by hand, and then have them find out how to use the statistical functions of their calculators for future calculations. Lately, along with other instructors, I have been showing them how to use Excel for calculations and graphing.”

5. Jake Schwartz — Software Engineer

“I think scientific (nongraphing) machines would get more use if they were more powerful like the “big boys”, but were extremely portable like a cellphone or 15C. With 64K of RAM, 42S-like programming, flash-memory storage, USB 2.0 I/O, fast CPU and high-contrast LCD in a truly pocketable size, I think many people would adopt a machine and take it with them.”

6. Bill Quinlan — Lawyer

“My Palm PDA has an application called RPN which is a terrific scientific programmable calculator. I have ported almost all the programs I wrote on the HP41 to this application. The Palm has replaced all my HP calculators. For more info go to:

<http://www.nthlab.com/software/rpn/welcome.html> “

7. Jeremy Smith — Computer Programmer

“A few years ago Richard asked 'does the world need a new calculator?'. These days my unequivocal answer is 'Absolutely! - define calculator'.”

“Today’s question is 'how much do you use the machine?', and basically I don't – I'm covering the deficiencies of the calculator with a laptop. I've been trying to drive this point home for the last couple of years, and it occurred to me this spring to record my actual calculator usage until the conference. Here are the results so far.”

2006	Minutes	Usage
15 April	5	Arithmetic
24 April	5	Units, time
28 April	5	Arithmetic, units
1 May	5	Arithmetic
3 May	5	Hex base

2006	Minutes	Usage
17 May	1	Units
25 May	1	Arithmetic
28 May	3	Base
29 May	1	Arithmetic
10 June	1	Arithmetic
23 June	1	Base, arithmetic
Today 26 June	1	Arithmetic, time/date
73 days	34 mins	~ ½ min/day

“My half minute calculator usage per day, compared to 2-9 hours per day on the computer, is merely past habit (the nearest hex calculator in my computation space is my hp 49). Nobody else would buy an HP because it can do those calculations.”

“My main reason for not using the machine is speed – it's over two orders of magnitude slower than my laptop, and consequently and unfortunately impractical. As an example, I prototyped a brute force solution to the stamp problem on my hp 49, and since it was a bit slow, taking many minutes, reproduced it in php where it ran in under a second – hundreds of times faster. I used this program many times over the last few years, shipping packages of books. One time my calculator was closer than my laptop, so I ran it, but it was taking so long I went over to the computer and fired up a browser and ran the php version.”

<http://www.peak.org/~jeremy/calculators/stamps.php>

“Define Calculator”

“[My message to HP] We want a calculator 'concept', which can be found in hardware (a calculator), in software (as a general purpose language, with a calculator emulator as an application), and on PDAs and cellphones as their primary calculator.”

“Bill Wickes defined this concept when he invented the successor the hp-41 line. The concept was an 'electronic back of an envelope', or in other words, an exploratory tool for the student, engineer, scientist, and businessperson.”

“The calculator concept is implemented as a software platform - like Java, that runs anywhere including PDAs and cellphones. (Java ships a 'virtual machine' that runs on each type of hardware (Mac, PC, Unix, PDA, cellphone) and Java runs on the virtual machine. There are numerous such software platforms – SAS statistical analysis comes to mind.)”

“The Mathematica notebook is like a word processor but allows you to scribble in equations and bits of Mathematica code, and these are compiled inline producing the graphs, plots, animations and symbolic results right on the page. Talk about an electronic scribbling pad.”

“**Concept** – the essence of a calculator is that there is one key for common functions, like sine or plot. The 'calculator' software platform is a programming language with many specialized functions (a la a calculator) that works transparently between any portable device (like a laptop, PDA, cellphone, or an actual calculator). It is at heart a handheld calculator,

whereas Java is a general purpose programming language, and Mathematica notebook is a document.”

“It really already exists - RPL - but it needs to be liberated from its current constraint, and then allowed to spread, evolve and mature. And the Lisp-model RPL is a great programming environment, but it needs various levels of sugar coating to make it more palatable to different levels of users. An engineering professor friend of mine found the learning curve just not worth the payback. (This of course is a general problem, perennial and hard.)”

“I don't see something like this coming from a company, like HP. It's more likely to come from a high school kid trying to explain the math behind a game to his friend via their wirelessly linked handheld devices.”

“HP is in the computer business. If HP was in the education business (and education is in dire need of reinventing) it would be a different story. “

Conclusion

The primary purpose in taking this survey was to “take the temperature” of calculator usage by professionals. I can make several observations from the information provided by the respondents.

1. The hand scientific or graphing calculator is used because it is convenient, not because it is the best tool for the job.
2. Programming and customization are useful features of the machines mentioned by the respondents that make them convenient.
3. Another important aspect of being convenient is the saving of time. It is far faster to pick up a hand calculator and make a calculation than it is to turn on your computer and wait for it to boot.
4. The hand calculator is a tool. Its usefulness will depend on the skill level of its user. The simpler and easier to use the more convenient it becomes.
5. Convergence is not eliminating the hand calculator because of the factors listed above.

Thanks and Acknowledgement

I want to thank all of the respondents for taking the time and effort to respond to this survey. As always I am amazed at the diversity yet similarity of the technical people who use hand calculators. They tend to be the “hands on” personality types who want to see for them selves rather than just “read the book.” I feel very fortunate to have so many friends who will take the time to help me understand how problems are solved. It has always been amazing to me how the unique qualities of HP's machines attract such dedicated users. I look forward to seeing many of you at HHC 2006.

X <> Y,

Richard J. Nelson
July 24, 2006

Appendix A

Survey Questions

Professional Use of a Scientific or Graphing Calculator

1. What is your profession?
2. Do you own or use a Scientific or Graphing Calculator?
If YES, Which type, make and model?
If NO, Why not?
3. Did you use the same machine while in school?
4. How often, an estimated average, do you use your machine?
5. What kinds of problems do you use your machine for?
6. What computer software do you use to solve mathematic/design problems?
7. What is the most common use(s) you have for your machine?

Examples.

- A. Simple four function math (balancing the check book).
 - B. Conversions, especially English-Metric.
 - C. Interest calculations.
 - D. Repetitive calculations done with a short simple program.
 - E. Statistical calculations.
 - F. Higher level math calculations involving logs and trigonometric functions.
 - G. Very high level or advanced math functions such as integration, Bessel functions.
 - H. Specialized calculations involving complex dedicated programs.
 - I. Symbolic math calculations.
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8. Considering spread sheet programs, e.g. Excel. Do you see more use of a computer when dealing with multiple data compared to a calculator?
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